APPENDIX A

Version of Substitute Specification with Markings to Show the Changes Made

FIELD OF INVENTION

[0001] This invention relates to an anti-pinch and motor protection device. More specifically, the invention relates to a positive temperature coefficient ~~(hereinafter referred to as PTC)~~ circuit protector device ~~used with an alternator device to not only release a potentially pinched object but to also extend the life of the motor~~ for use in a motor drive circuit.

BACKGROUND OF INVENTION

[0002] In motor vehicles, motor driven devices, such as in windows and seat positioning, are becoming increasingly popular over standard manual devices. Consumers find it much easier and enjoyable to push a button to have the window go up and down or to move a seat into a desired position. Rolling windows down or positioning a seat manually is becoming increasing obsolete. However, these and other motor driven devices like them have been known to become dangerous for users if a body part or some other article gets caught while the motor is activating movement. While an object is caught, there can be a lot of stress on the motors and they may burn out if they become too hot or even just shut off. If this happens, the body part or article caught is still pinched and cannot be released until the motor cools and is reset. This can result in serious damage or injury. The solution to that problem has been to use load sensing devices in line with a motor power output or combined current/speed sensors with sophisticated and expensive software plus motor thermal protection systems. Examples of such devices for motor driven windows include U.S. Patent

Application Publication Nos. 2003/0151382 AI, 2003/0137265 AI, 2002/0190680 AI, and 2001/0048280. U.S. Patent Nos. 6,548, 979, 6,404, 158 and U.S. Patent Application Publication Nos. 2002/0121872 and 2002/0101210 solve this problem for more devices [[then]] than just motor driven windows. The devices in these applications solve the problem for door positioning, windows, sliding panels (such as a sunroof), seats, control petals, steering wheel, etc.

[0003] While the above listed inventions help move the technology for motor driven devices in motor vehicles forward, they are very costly and make cars more expensive for consumers. ~~This invention allows consumers to keep their motor driven windows, seat, sliding panels, etc. while keeping costs down. This invention combines the anti-pinch and motor protection function by replacing the sophisticated and costly anti-pinch devices while still retaining circuit protection PTC features at the same cost.~~ Thus, there remains a need in the art for a simple and inexpensive device that prevents possible pinching and damage or injury to an object caught by a motor driven assembly. There further remains a need for a device of this type that also protects the motor from damage in a pinching event.

SUMMARY OF INVENTION

[0004] This invention relates to an anti-pinch and electrical motor protection device comprising at least one PTC circuit protector, and a diode. ~~, and an electrical current.~~ This invention will preferably have two PTC circuit protectors comprising one PTC circuit protector tuned to a low temperature and one PTC circuit protector tuned to a high temperature.

[0005] In cases where a body part or an article is caught and thereby putting stress on the motor, the motor will tend to overheat. Once the temperature becomes too high for the PTC circuit

protector tuned to a low temperature, the PTC circuit protector is tripped and the electrical current is stopped. The tripped PTC circuit protector may be bypassed in an opposite direction through the diode, which ~~until the PTC circuit protector tuned to a high temperature is tripped. This action~~ allows for the reversal of the direction of the motor thereby releasing the pinched object and extends the life of the motor.

~~This invention can be used with any DC type motor.~~

DETAILED DESCRIPTION OF DRAWINGS

[0006] FIG. 1 is a perspective view of the positive temperature coefficient circuit protector device of the present invention; ~~circuit~~[[.]];

[0007] FIG. 2A is a perspective view of the positive temperature coefficient circuit protector device of the present invention ~~circuit~~ in normal mode[[.]];

[0008] FIG. 2B is a perspective view of the positive temperature coefficient circuit protector device of the present invention indicating a break in the current flow when the temperature threshold is exceeded ~~tripped circuit~~[[.]];

[0009] FIG. 2C is a perspective view of the positive temperature coefficient circuit protector device of the present invention indicating the second current flow in the second direction when the temperature threshold is exceeded ~~bypassing through diode until the PTC circuit protector tuned to a high temperature is tripped~~[[.]];

[0010] FIG. 3 is a schematic view of the positive temperature coefficient circuit protector device of the present invention indicating the possible paths of current flow ~~current direction allowed~~

~~in ranges of temperature. When the temperature is below 125 degrees Celsius in preferred embodiment, current runs in both directions. No current runs above 150 degrees Celsius in the preferred embodiment~~[[.]];

[0011] FIG. 4 is a schematic diagram of the positive temperature coefficient circuit protector device of the present invention ~~and electrical diagram of connections~~[[.]]; and

[0012] FIG. 5 is a graph of system resistance through the positive temperature coefficient circuit protector device of the present invention versus temperature~~, which shows the increased motor protection capabilities~~.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0013] In its preferred embodiment, this invention will be used in motor driven windows, seat, roofs, or any other component of a motor vehicle that utilizes a DC motor. FIG.2A shows the current flow through positive temperature coefficient (herein after referred to as PTC) circuit protector device of the present invention ~~circuit~~ in its normal mode. In its normal mode, seen in FIG. 2A, the electrical current 14 travels through [[over]] the PTC circuit protector, indicated at 8, is tuned to a first, or lower temperature [[8]], generally around 125 degrees Celsius and through the PTC circuit protector, indicated at 10, is tuned to a second, or higher temperature, generally around 150 C. The tuned temperature of the PTC circuit protector tuned to a [[low]] lower temperature 8 can be [[is]] any appropriate temperature as long as there is a difference between the temperature of the PTC circuit protector tuned to a [[low]] lower temperature 8 and [[a]] the PTC circuit protector tuned to a [[high]] higher temperature 10. When the motor is running as it should and there is nothing pinched under the motor driven device, the electrical current has no problem traveling across the

PTC circuit protectors ~~protector tuned to a lower temperature~~ 8 and 10. However, in motor driven windows, seats, roof, etc., there is always the risk that an object, a body part, or article of clothing will get pinched. Once that happens, there is high stress on the motor, shown as M in Figure 4, ~~(not shown)~~ running that window, seat, or roof. That stress can result in the motor M ~~(not shown)~~ malfunctioning or even [[cease]] ceasing to function. That can cause severe damage to the motor M ~~(not shown)~~ and delay getting an object out of its pinched position, resulting in damage or injury.

[0014] In [[this]] the preferred embodiment, if the motor driven device (not shown) pinches something within it, [[and]] the motor ~~(not shown)~~ M stalls and begins to draw higher current, which overheats the circuit above the first, or lower temperature to which that the PTC circuit protector 8 is tuned ~~to a lower temperature 8 can handle,~~ so that the circuit is tripped, as indicated in Figure 2B. As shown in Figure 5, the tripping of the circuit is caused by a logarithmic increase in the resistance of the PTC circuit protector tuned to a first, lower temperature 8 as its tuned temperature is reached. This extreme increase in resistance reduces the current flow to a trickle, effectively stopping the motor M and avoiding damage or injury.

[0015] As shown in Figures 1 through 4, to allow a reversing of the motor M, a diode 12 is electrically connected in parallel with the PTC circuit protector tuned to a first, lower temperature 8. The diode 12 is oriented so that the current flow 14 can be reversed, as shown in Figures 2C and 3, and flow through the diode 12 around the tripped PTC circuit protector tuned to a first, lower temperature 8, and through the PTC circuit protector tuned to a second, higher temperature 10 to drive the motor M in the opposite direction. ~~Instead of the motor (not shown) simply shutting off until it cools enough to reset, instant reverse motion of the motor (not shown) is available by bypassing the tripped PTC circuit protector at a low temperature 8 through the diode 12 until the~~

~~PTC circuit protector tuned at a high temperature 10 is tripped.~~ The PTC circuit protector tuned to a second, higher temperature 10 continues to protect the motor M in the opposite direction if a problem continues to exist that would cause further overheating of the circuit. This ~~instant~~ continued capability for reverse motion allows for any object pinched to be released safely and without damage to the motor ~~(not shown)~~ M and perhaps only minimal damage or injury to the pinched object. Furthermore, ~~because~~ the motor cannot run back in the direction of pinching until the circuit and the PTC circuit protector tuned to a first, lower temperature 8 cool down below the tuned temperature. ~~Generally, in its preferred embodiment, the PTC circuit protector tuned to a high temperature 10 is tuned to a temperature around 150 degrees Celsius. The PTC circuit protectors can be tuned to any temperature, as there is a temperature difference between the PTC circuit protector tuned to a low temperature 8 and the PTC circuit protector tuned to a high temperature 10.~~

~~FIG. 5 depicts in graph form what happens as temperature and resistance increase. When the resistance on a motor is increased, the temperature also increases until the PTC circuit protector tuned to a lower temperature is tripped. At that point, reverse polarity PTC (PTC circuit protector tuned to a higher temperature 10) trips and allows the motor~~

~~to run at a higher temperature even though the resistance may be the same as it was at the lower temperature.~~

[0016] This invention is very important to any DC driven motors within a motor vehicle because of not only is safety and motor protection features, but also because it is a very easy way to keep down costs of a motor vehicle. This invention is a simplified way of meeting consumer demands for safety and meeting manufacturer's demands for motor protection without using costly software.

[0017] The above presents a description of the best mode contemplated for carrying out this invention. The claims should not be read as limited to the described order or elements unless stated to that effect. Therefore, all embodiments that come [[with]] within the scope and spirit of the following claims and equivalents thereto are claimed as the invention.

ABSTRACT OF THE INVENTION

~~An anti-pinch and electrical motor protection device comprising at least one PTC circuit protection, a diode, and an electrical current. When an object becomes pinched in a device driven by a DC motor, the temperature within the motor increases. When the temperature exceeds the temperature the PTC circuit protector tuned to a low temperature can handle, it is tripped and the electrical current is bypassed through the diode until the PTC circuit protector tuned to a high temperature is tripped. Instant reverse motion of the motor is then available without having to wait for the motor to cool and reset, thereby releasing a pinched object with minimal damage and protecting and extending the life of the motor.~~ An anti-pinch and electric motor protection device includes a positive temperature coefficient circuit protector having a predetermined temperature threshold and is adapted to be in electrical series with a DC circuit to allow current flow in a first direction and in a second opposite direction when the positive temperature coefficient circuit protector is below the threshold and to block current flow in either direction when the positive temperature coefficient circuit protector is above the threshold. A diode electrically in parallel with the positive temperature coefficient circuit protector is adapted to block current flow in one of the directions.